

## Article by Alexander Graham Bell, June 5, 1892

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**3-2-12 Copied from the Beinn Bhreagh Recorder for April 14, 1910. THE FLYING-MACHINE OF THE FUTURE; Aviation - 16 AS CONCEIVED IN 1892 By Alexander Graham Bell**

(The following article was dictated by Mr. Bell at Hotel Bellevue, Boston, Mass., June 5, 1892, and was taken down by Mr. Arthur W. McCurdy. It has been found preserved in a little volume of Dictated Notes entitled "Half Hour Evening Talks on Various Subjects". M. B. McC.)

June 5, 1892: — The day is coming when artificial flight will no longer be a theoretical conception of the thinker but an accomplished fact.

Now I imagine when we come to take a journey from Boston to New York through the air in the flying machine of the future we shall take our seats in a car, the machine will then rise vertically into the air to some considerable height and then shoot off horizontally in the direction of New York. When we arrive at our destination I imagine the machine will hover over the terminus and gradually sink down to a moderate distance from the earth, a rope will be then thrown down to people below, and the machine by means of this rope will then be pulled down into position upon the terminal station.

In order that there may be safe ascent and descent it seems to me necessary that the machine must have the power of hovering in the air at any desired height, and of ascending or descending slowly without horizontal velocity.

In order that there may be translation from place to place the machine must also be capable of horizontal motion in any desired direction.

Now, what are the essential features of such a machine?

The first essential is that it must be independent of ordinary currents of wind. No machine that is at the mercy of the wind can practically fulfil the purposes of a flying machine.

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In this connection it is obvious that the greater the specific gravity of the machine the less effect will wind have upon it; and conversely the less the specific gravity the more will it be at the mercy of atmospheric currents.

The essential condition therefore of the successful flying machine is, that it shall be specifically heavier than the air, and the greater its specific gravity compared with the air the more independent it will be of atmospheric conditions.

Any machine that is specifically heavier than the air can only be supported by mechanical motion of some sort, and the question is what sort of mechanical motion we are to use, and how it shall be applied.

It is significant in this connection that all the flying creatures of the earth, from the humblest insect up to the soaring eagle, all fulfil the above conditions. They are all specifically heavier than the air; and in all, flight is accomplished by the agency of extended surfaces called wings. Hence we may conclude that the flying machine of the future will have wings; it will consist of a car, or a body specifically heavier than the air and be supported by the motion of flat, extended surfaces or wings.

Of course, an engine of some sort will be employed to give motion to the wings.

Of the different motive powers available, that one will be most suitable that has the least weight proportionate to its power.

Electricity, so far as our present knowledge extends, is out of the question, as all the machines for utilizing electrical force yet known have great weight; the choice lies between steam and some form of gas engine, with the probabilities in favor of gas.

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At the present time, however, we can get more power out of steam with less weight in the machinery than in any other way, and steam will undoubtedly be the first motive power employed in flying machines; but, as improvements progress, chemical compositions will be employed which can be made to generate gases in enormous volume. For example: If gun powder, dynamite, or nitro-glycerine could be so modified as to be safely used as gas producers, they would probably yield an enormous amount of power with very little weight, and be the best agencies for the purpose. Invention will undoubtedly adapt them for the purpose of artificial flight after flying-machines have been made practical by means of heavier agencies. Gun powder has already been made slower in its action and I look forward with hope to its use as a substitute for steam as a motive power for machines of this character.

The idea of using a jet of steam or gas in this connection was original with myself, and occurred to me a long time ago, also the use of gun powder in the shape of horizontal rockets attached to the wings. I am fortified in my belief in the efficacy of jets for this purpose by the opinion expressed by Lord Raleigh in a letter to Nature suggesting as a motive power jets of steam, and gun powder, which did not come under my attention until after I had made experiments with jets of steam and alcohol at Beinn Bhreagh.

I have hitherto considered only the hovering action of the machine, which I conceive will be produced by jets of steam or gas projected in opposite directions from the extremities of two wings, thus causing rotation of the apparatus.

When sufficient height has been obtained I conceive that the rotating motion can be changed into a motion of translation in a horizontal direction by reversing the direction of

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the jet of one of the wings, at the same time tipping the plane of its attached wing; so that the two jets will then be projected in the 4 same direction, and the two wings tilted alike, instead of being opposed.

The first effect of the reversal of the jet would be to cause the machine to move in a circular path, the center of rotation no longer being the axis, but some point outside located either at the extremity of the wing where the jet is reversed or at some point outside the machine altogether. The machine, instead of simply rotating upon its axis, would sweep round in a circle of increasing diameter until the reversed jet has overcome the inertia of the wing to which it is attached, and has commenced to propel it in the same direction as the other wing. The machine should then move in a straight line in a horizontal direction after the manner of the proposed flying machines of Prof. Langley and Mr. Maxim. It would then move on its path without rotation.

On arrival over the place of destination the jet would agin be reversed and the machine would move in a circle of decreasing diameter until at last it would remain stationary, but in rotation like a top.

The rotation, however, need not be rapid enough to create dizziness to the occupants of the car, for it is obvious that with wings extending sufficiently from the center to support the apparatus a high velocity might be consistent with slow rotation.

For example, if each wing extended 20 feet from the axis of the machine the circular path traced by the extremity of each wing would exceed 120 feet, so that a velocity of 60 feet per second would occasion only one rotation in two seconds. The velocity of rotation being diminished the machine gradually descends towards the earth; a rope will then be let down containing at its extremity a heavy weight. When this touches the earth, the machine, relieved of the weight, no longer descends, but remains stationary. Assistants below seize hold of the rope and moor 5 the machine in the place of descent. The machine is then pulled down while the wings are still rotating, until it comes in contact with a revolving

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platform or other suitable support. The rotation of the wings is then gradually decreased until the machine is brought to rest. Thus descent can be accomplished without shock and the serial voyagers safely descend to terra firma. In landing in a strange place the machine will be anchored to the ground; an assistant can descend the rope and complete all fastenings below, the passengers can be then let down by rope from the car.

AGB